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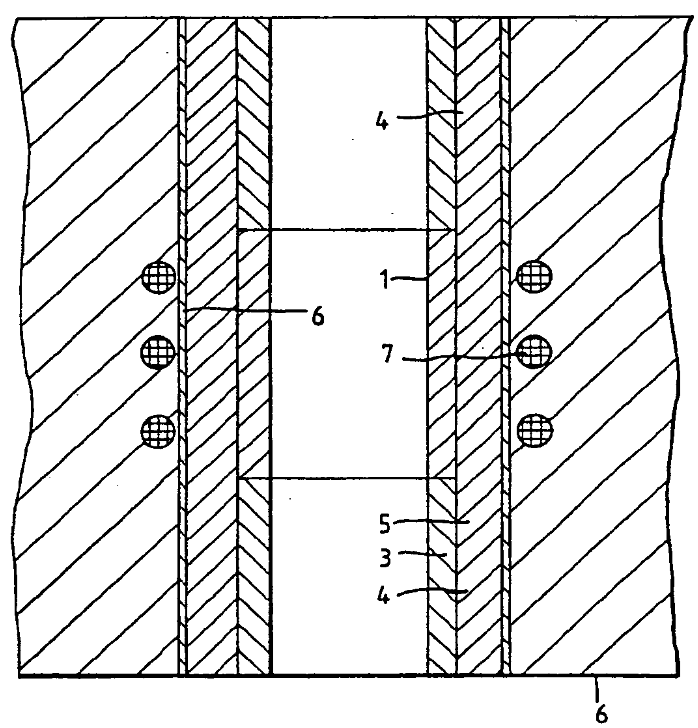
F4B

(54) Tube furnace

(57) An induction furnace for drawing glass optical fibres from a preform has a R.F. powdered (7) susceptor element comprising a zirconia ring (1) within which the work if heated, located end wise between upper and lower rings (3), e.g. of silica, silicon carbide, alumina, titania, the zirconia ring (1) along its entire length reaching temperatures above any phase change so that the preform and fibre are not contaminated by zirconia particles. The three rings are located inside a tubular zirconia support 4 and a silica "can" 6.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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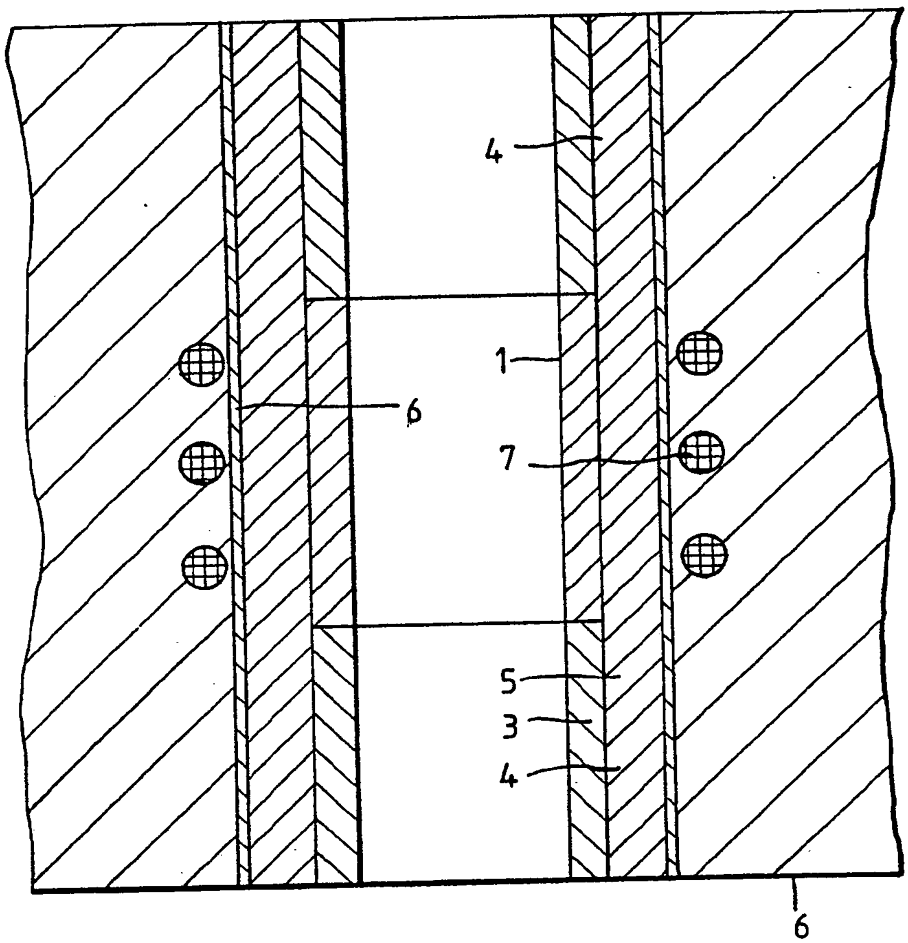

SPECIFICATION

Tube furnace

This invention relates to tube furnaces such as are used for the drawing of glass optical fibres from optical fibre preforms.

A furnace is needed in optical fibre production to soften the tip of a preform sufficiently to enable it to be drawn into fibre. For this purpose a temperature in the region of 2000°C is needed. A furance used for this purpose has a tubular susceptor element within which the preform is heated, which element is sometimes made from yttria stabilised zirconia, in view of its highly refractory characteristics. Heating is in one case by the use of radio frequency energy inductively coupled into the central portion and the susceptor element, which is thereby held at 2100°C. There is an associated temperature gradient to a lower temperature such as several hundreds of degrees at the end of the element on either side of this hot zone. The temperature gradients cause the zirconia to undergo changes in thermal expansion coefficient, causing dimensional changes and internal stresses. This can cause particles to be dislodged from the zirconia, which particles could contiminate the preform and the fibre being drawn therefrom. Particles thus embedded in the fibre surface cause the fibre to fail at low strain by acting as stress intensifiers and flaw generation sites.

An object of the invention is to produce a susceptor element for a zirconia induction furnace in which the above-mentioned difficulties are reduced or even eliminated.

According to the invention, there is provided a tubular susceptor element for a zicronia induction furnace, which includes a zirconia susceptor ring within which the work is heated when the element is in use, which susceptor ring is located end wise between two adjacent rings.

These adjacent rings can be of a variety of materials, such as alumina, titania, silicon carbide or silica, but silica is preferred when heating silica. This is because if there is a risk of contamination, the contaminant would be of the same material as the fibre preform.

Thus in accordance with a preferred aspect of the invention, there is provided a tubular susceptor element for a zirconia induction furnace, which includes a zirconia susceptor ring within which the work is heated when the element is in use, which susceptor ring is located between two silica rings each of which has a similar cross-section to the susceptor element, with the three rings arranged in end-on contiguous relation.

An embodiment of the inventions will now be described with reference to the accompanying highly schematic drawing.

The arrangement shown in the drawing was a composite structure with a central susceptor ring 1 of zirconia supported by a silica ring 2 below it, with a second silica ring 3 above it. These three rings are all of the same diameter, and is inside an outside tube support 4, also of zirconia. The whole is surrounded by an insulating zirconia grog 5, held in a silica "can" 6. This is within an RF work coil indicated at 7.

The relative dimensions of three rings are such that the silica does not see temperatures in excess of Tg, i.e. 1730°C, while the zirconia ring 1 is maintained at all points at a temperature above any phase change associated with its partially-stabilised composition. The reduction of the length of the zirconia tube 1 means that the temperature differences across its length are reduced, which minimise the chance of particle emission.

The composite tube, which is inside an external can 6, has in one case a length of 200mm, of which the zirconia ring's length is about one third.

CLAIMS

1. A tubular susceptor element for a zirconia induction furnace, which includes a zirconia susceptor ring within which the work is heated when the element is in use, which susceptor ring is located end wise between two adjacent rings.

2. A tubular susceptor element for a zirconia induction furnace, which includes a zirconia susceptor ring within which the work is heated when the element is in use, which susceptor ring is located between two silica rings each of which has a similar cross-section to the susceptor element, with the three rings arranged in end-on contiguous relation.

3. A susceptor element as claimed in claim 1, in which said three rings are located inside a further zirconia ring which is itself held in a silica container.

4. A tubular susceptor element for a zirconia induction furnace, substantially as described with reference to the accompanying drawing.

5. An induction furnace which includes a susceptor element as claimed in claim 1, 2, 3 or 4, fitted with a radio frequency coil.

6. A method of drawing glass optical fibres from a preform, wherein the fibre is drawn from the tip of a said preform as it is heat-softened by entry into an r.f. powered susceptor element as claimed in any one of the preceding claims.

CLAIMS

Amendments to the claims have been filed, and have the following effect:—

New or textually amended claims have been filed as follows:—

7. A tubular susceptor element for a zirconia induction furnace, which includes a zirconia susceptor ring within which the work is heated when the element is in use, so that

the hot zone is surrounded by the zirconia inner surface of the susceptor element, which zirconia susceptor ring is located between two silica rings each of which has a similar internal cross-section to the internal cross-section of the zirconia ring, the three rings being arranged in end-on contiguous relation.

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